BLENDED LEARNING: SYSTEMATIC LITERATURE REVIEW IN THE CONTEXT OF COVID19 PANDEMIC

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ABSTRACT

This paper examines the concept of blended learning, which combines traditional face-to-face classroom instruction with online learning activities. Blended learning offers a flexible and adaptable educational experience, incorporating the strengths of both traditional and online modalities. The COVID-19 pandemic has emphasized the importance of blended learning by enabling remote learning while maintaining human interaction. The advantages of blended learning, including flexibility, active learning, personalization, and scalability. Various blended learning models, such as the Rotation Model, Flex Model, Self-Blend Model, and Enriched Virtual Model, are used for their unique characteristics. However, blended learning also presents challenges, such as ensuring equitable access to technology, integrating online and face-to-face components effectively, evaluating different models, and implementing best practices. To address these challenges, a systematic literature review was conducted, identifying 12 relevant articles for analysis. The paper explores the advantages of blended learning and highlights challenges related to technology, pedagogy, social interaction, assessment, and institutional support. Potential solutions are proposed, including infrastructure improvement, technical support, instructional design assistance, fostering social presence, and implementing appropriate assessment practices. Overcoming these challenges and implementing suggested solutions can enhance the implementation of blended learning and improve the learning experience for students and educators in higher institutions of learning.

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INTRODUCTION

Blended learning, also known as hybrid learning, refers to an instructional approach that seamlessly integrates traditional face-to-face classroom instruction with online learning activities (Tayebinik & Puteh, 2013). Unlike traditional learning, which relies solely on in-person interactions, and e-learning, which is entirely conducted in a virtual environment, blended learning strikes a delicate balance between the two modalities. By harnessing the strengths of both traditional and online learning, blended learning offers a dynamic and adaptable educational experience (Anthony *et al.*, 2022; Megahed & Hassan, 2021). Notably, in the context of COVID-19 pandemic, blended learning has gained even greater significance due to its ability to facilitate remote learning from the comfort of learners' homes while still maintaining crucial human interaction (Juhi *et al.*, 2023).

Blended learning discusses numerous advantages to both learners and educational institutions alike. Firstly, it provides learners with enhanced flexibility in terms of when and where they can engage with learning materials (Tayebinik & Puteh, 2013). Learners can access online resources, such as lecture recordings and multimedia content, at their own pace, accommodating diverse learning styles and schedules (Castro, 2019; Smith & Hill, 2019). Secondly, blended learning promotes active learning through a variety of interactive online activities, fostering engagement and enhancing knowledge retention (Smith & Hill, 2019; Tayebinik & Puteh, 2013). Additionally, this approach enables personalized learning experiences, allowing learners to tailor their educational journey to their specific needs and interests (Ashraf *et al.*, 2021). From the perspective of educational institutions, blended learning offers cost-effective opportunities to scale educational programs, reach geographically dispersed learners, and promote lifelong learning (Graham, 2013).

Blended learning has witnessed notable advancements with the emergence of various models, each exhibiting unique strengths and characteristics. (Bryan & Volchenkova, 2016) explains

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the different modes as follows; The "Rotation Model" involves students rotating between different learning modalities, combining face-to-face instruction with online learning (Ayob *et al.*, 2020). The "Flex Model" provides learners with flexible schedules and customized learning paths, blending online instruction with teacher-led support (Ashraf *et al.*, 2021). The "Self-Blend Model" permits learners to select online courses in addition to their traditional classes, empowering them with greater autonomy and control over their learning (Bryan & Volchenkova, 2016; Krismadinata *et al.*, 2020). Lastly, the "Enriched Virtual Model" primarily relies on online instruction but incorporates periodic face-to-face interactions to enhance engagement and collaboration (Krismadinata *et al.*, 2020). These advances in blended learning models offer educators diverse options to cater to different learning needs and preferences.

Despite its numerous advantages, blended learning also presents challenges that warrant further investigation. One significant challenge lies in ensuring equitable access to technology and reliable internet connectivity for all learners, particularly those from disadvantaged backgrounds (Gqokonqana *et al.*, 2022). Another challenge pertains to effectively integrating online and face-to-face components to create a seamless and cohesive learning experience (Gqokonqana *et al.*, 2022). Additionally, evaluating the effectiveness of different blended learning models and identifying best practices in their implementation necessitate rigorous research. Therefore, a comprehensive literature review is essential to address this existing research gap and provide evidence-based solutions to these challenges.

METHODOLOGY

A Systematic Literature Review was conducted following established guidelines by (Kitchenham *et al.*, 2009) to ensure methodological rigor and comprehensiveness in investigating the implementation of blended learning. The review process adhered to the principles of systematic literature review, including a clear purpose, multiple appraisers for article evaluation, well-defined inclusion/exclusion criteria, and the adoption of specific research questions to guide the inquiry. By extensively examining the existing literature, this study aimed to identify existing knowledge, identify gaps, and uncover areas that require further exploration in the realm of blended learning.

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Search Strategy

The search for the term "blended learning" was conducted employing a comprehensive set of search parameters to facilitate the retrieval of pertinent and encompassing results. These parameters encompassed the inclusion of the primary keyword "blended learning" alongside synonymous and associated terms, such as "hybrid learning," "mixed-mode learning," or "integrative learning." Boolean operators, including AND, OR, and NOT, were strategically employed to refine search queries, enabling the exploration of specific dimensions, such as the intersection of blended learning with pedagogy or the consideration of articles that discuss either term.

To ensure accuracy of the retrieved literature, a specified date range, typically within the past five years, was established. Furthermore, the selection of English language articles and the utilization of reputable databases such as IEEE Explore, ACM Digital Library, Google Scholar, Emerald, and Taylor and Francis further ensured access to a diverse and scholarly range of resources. This comprehensive search approach was instrumental in maximizing the likelihood of obtaining a broad selection of articles that contribute significantly to the current understanding and knowledge base pertaining to blended learning.

Data Collection

Using the aforementioned search terms, a comprehensive search was carried out across selected databases, including ACM Digital Library, Emerald Insight, IEEE Explorer, Google Scholar, and Taylor and Francis, resulting in the retrieval of a total of 3741 studies. These papers underwent a thorough process of inclusion and exclusion, aiming to eliminate irrelevant findings and focus solely on peer-reviewed articles from reputable journals and conferences. Consequently, non-academic works such as periodicals and white papers were excluded from the study. Furthermore, papers that were not written in English, lacked full-text availability, or fell outside the designated publication timeframe of 2019 to 2023 were excluded, resulting in the removal of 3610 articles. Subsequently, a thorough evaluation of the titles and abstracts was conducted to ascertain their relevance to the research questions. Further scrutiny of the article contents was performed for screening purposes, leading to the exclusion of an additional 115 articles that did not adequately address the pertinent issues related to blended learning.

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Finally, a meticulous quality appraisal was undertaken on the remaining papers, resulting in the identification of a final set of 12 articles that satisfied the stringent inclusion criteria and were deemed suitable for further analysis and examination as indicated in the table 1 below.

No.	Author	Title	Year	Study Area
1	Castro, R.	Blended learning in higher education: Trends and capabilities	2019	This paper aims to identify some of the most promising trends in blended learning implementations in higher education, the capabilities provided by the technology (e.g., datafication), and the contexts of use of these capabilities
2	Ashraf, M.A., et al.	A systematic review of systematic reviews on blended learning: Trends, gaps and future directions.	2021	This paper aimed at a systematic review of systematic reviews on BL, based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to identify BL trends, gaps and future directions.

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3	Namyssova, Gulnara, et al.	Challenges and benefits of blended learning in higher education	2019	This study aimed at the effectiveness of a graduate level blended learning course on the development of teachers, and educational leaders in Kazakhstan studying a Master's of Science in Educational Leadership.
4	Dwivedi, Alka, et al.	Factors affecting students' engagement with online content in blended learning	2019	This study investigated the importance of engagement of students and teachers in blended learning with a focus on factors which affect this engagement.
5	Keržič, Damijana et al.	Exploring critical factors of the perceived usefulness of blended learning for higher education students	2019	This study was investigated the factors that influenced the way a student perceives an e-course's usefulness in a blended learning environment.
6	Ghazal, Samar et al.	"I am still learning": Modeling LMS critical success factors for promoting students' experience and satisfaction in a blended learning environment.	2018	This paper examined the effects of critical success factors on students' experience and satisfaction with the LMS in a blended learning setting.

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7	Maleesut, Thanakrit, et al.	Gen X STEM teachers' perceived usefulness and challenges of a blended-learning system.	2019	This paper focused on the Challenges that Gen X teachers may have held which hinder students from adopting Blended learning.
8	Rasheed, Rasheed Abubakar et al.	Challenges in the online component of blended learning: A systematic review.	2020	This review was conducted with the aim of identifying the challenges in the online component of blended learning from students, teachers and educational institutions perspectives.
9	Rasheed, Rasheed Abubakar et al.	Students and teachers' challenges of using technology in blended learning environments	2020	This study aimed at identifying the challenges that students and teachers' face with technological use in blended learning environments.
10	Anthony, Bokolo et al.	Blended learning adoption and implementation in higher education: A theoretical and systematic review.	2022	This paper explores the theoretical foundation of BL studies and how BL were adopted and implemented in relation to students, lecturers and administration.

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11	Serrano, Dolores R., et al.	Technology-enhanced learning in higher education: How to enhance student engagement through blended learning.	2019	This article aimed at increasing awareness of higher education educators about how traditional face-to-face learning can be transformed into blended courses so as to develop student engagement with both in-class and online approaches.
12	Kabarungi, M., Ejiri, A. H., & Kawuma, S	Requirements for a Blended Learning Framework in Higher Educational Institutions in Uganda	2023	This study aimed at developing a Requirement Specification Document as an input for designing a BLF that to enhance the adoption of BL in HEIL in Uganda.

Table 1: Summary of the Selected Studies

Quality Appraisal Criteria

The study followed a set of criteria, which were employed to assess the quality of each selected paper, aiming to determine the relevance of the original study's findings and interpretations (Kitchenham *et al.*, 2009). A rigorous quality evaluation was conducted for this review, utilizing specific questions to gauge the appropriateness of the research and its potential contribution to the scope of inquiry. The grading technique for the articles was established as follows: "Yes" was assigned a value of 1, "Partial" was assigned a value of 0.5, and "No" or "Unknown" (when information was not provided) were assigned a value of 0. To commence the evaluation, a research paper that fully met the requirements received a rating of 1. Subsequently, a research paper that only partially fulfilled a quality requirement was assigned

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a rating of 0.5. Lastly, a research paper that failed to satisfy a quality requirement received a rating of 0. The grading of the research questions adhered to the aforementioned criteria. Based on the outcomes of the quality assessment, whereby a score of Y=1, P=0.5, and N=0 was awarded to each question, the most qualifying papers obtained a score of 3 points, while the least qualifying papers obtained a score of 0 points. Consequently, the study selected papers that achieved scores ranging from 2.5 to 3 points, ensuring a high standard of quality for inclusion in the review as indicated in figure 1 below.

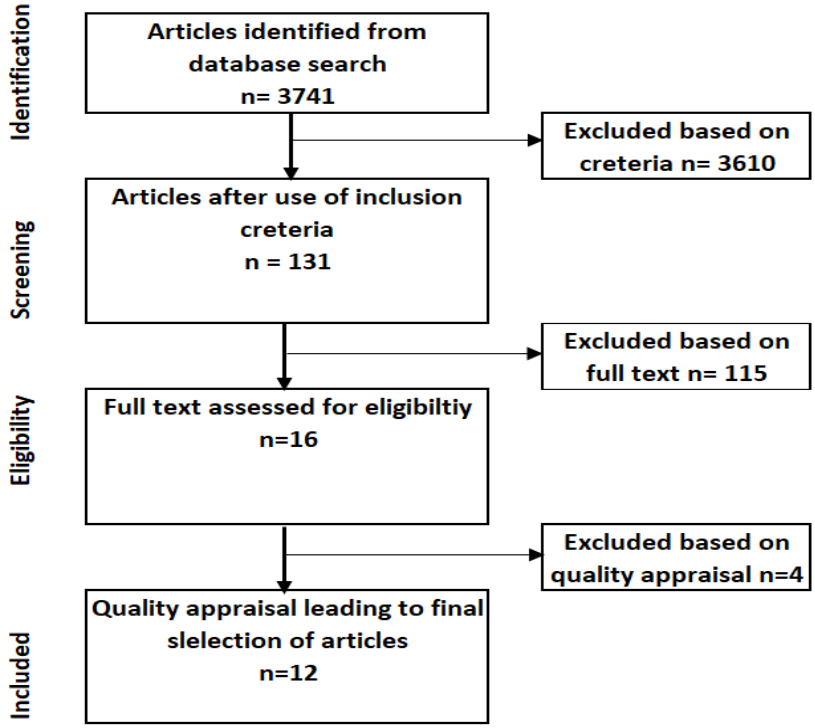

Figure 1: Flow diagram for studies selected.

RESULTS

The 12 articles were research papers, since the inclusion/exclusion criteria targeted only journal and conference papers. Among these, 5 were based on qualitative research methodology, while 4 quantitative based paper and 3 used mixed methods. The publications were produced both from high-income and middle-income countries as named; Norway (1), Spain (1), Slovenia (1), Colombia (1), China (1), India (1), Kazakhstan (1), Malaysia (3), Thailand (1) and Uganda (1).

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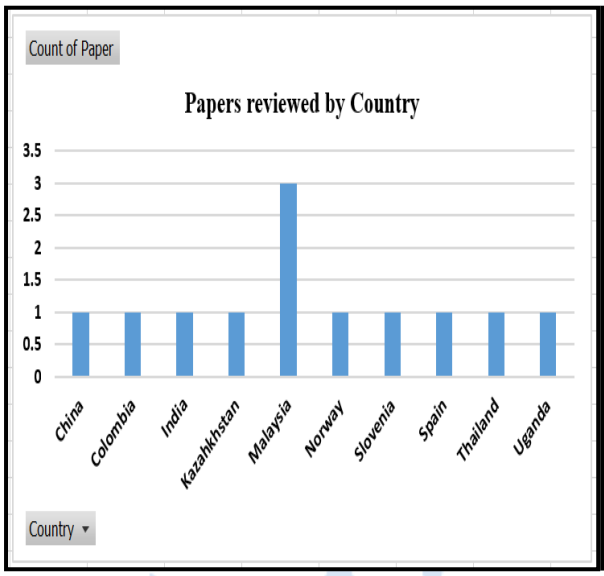
According to Location, most of the papers were from Asia. Although the search was limited to 2011 to 2020, the selected articles range from 2019 to 2023 as shown in Figure 2 and 3 below.



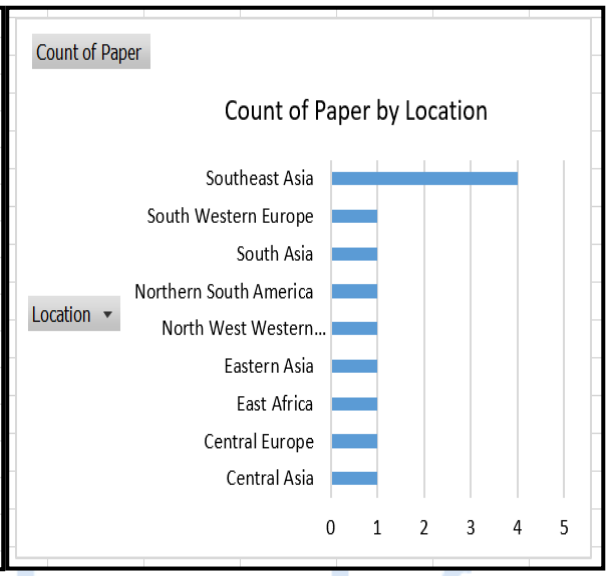


Figure 2: Paper by Country *Figure 2: Paper by Location*

DISCUSSION

Advantages of Blended Learning

Blended learning offers several key advantages that enhance the overall learning experience. Firstly, it provides flexibility and personalization for learners, allowing them to access educational content and engage in activities at their own pace and convenience (Castro, 2019).This adaptability enables learners to take control of their learning journey, catering to their individual needs and preferences (Rasheed *et al.*, 2020b). Additionally, blended learning fosters active engagement and interaction among learners, promoting a dynamic learning environment (Kabarungi *et al.*, 2023). Through various online platforms and tools, learners can actively participate in discussions, collaborate on projects, and receive timely feedback, facilitating deeper understanding and knowledge retention (Castro, 2019).

Furthermore, blended learning enhances accessibility and reach by overcoming geographic barriers. Learners from diverse locations can access educational resources and participate in

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online discussions, expanding the reach of education beyond traditional physical boundaries (Keržič *et al.*, 2019; Namyssova *et al.*, 2019). This inclusive approach also caters to different learning styles and needs, accommodating individual preferences and supporting diverse learners. Additionally, blended learning allows for the customization of learning paths, enabling learners to follow personalized paths that suit their abilities and interests (Rasheed *et al.*, 2020b).

Moreover, blended learning promotes collaboration and social learning, facilitating peer-to-peer interaction and knowledge sharing (Ashraf *et al.*, 2021; Kabarungi *et al.*, 2023). Through online platforms and collaborative projects, learners can engage with their peers, share insights, and collectively construct knowledge. This collaborative approach cultivates valuable communication and teamwork skills that are essential for success in the modern world (Ghazal *et al.*, 2018).

Blended learning also influences technology to deliver an effective learning experience. It incorporates interactive multimedia resources, such as videos, simulations, and virtual experiments, which enhance learner engagement and understanding (Ashraf *et al.*, 2021; Castro, 2019). Additionally, the integration of learning analytics provides valuable insights into learners' progress and performance, enabling educators to tailor instruction to individual needs and optimize the learning process (Ashraf *et al.*, 2021).

Furthermore, blended learning offers cost-effectiveness and resource optimization. By reducing the need for extensive physical infrastructure and travel expenses, it minimizes the financial burden on educational institutions and learners (Castro, 2019). Additionally, the efficient use of classroom space and resources ensures optimal utilization, maximizing the benefits derived from available resources (Namyssova *et al.*, 2019). Blended learning also promotes the use of open educational resources (OER), which are freely accessible and adaptable educational materials, thereby reducing the reliance on costly textbooks and promoting equitable access to quality education (Anthony *et al.*, 2022; Ashraf *et al.*, 2021; Serrano *et al.*, 2019).

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Challenges of Blended Learning

Technological Challenges, the integration of technology in blended learning presents various challenges that need to be addressed. One major challenge is the availability and accessibility of infrastructure and connectivity (Ashraf *et al.,* 2021; Castro, 2019). In certain regions, students may have limited access to reliable internet connections and devices, hindering their participation in online learning activities (Baticulon *et al.,* 2021). Additionally, the lack of technology resources in some educational institutions can further exacerbate this issue. Moreover, providing adequate technical support is crucial to ensure smooth functioning of blended learning environments (Anthony *et al.,* 2022). Students and instructors may encounter technical difficulties during online activities, and having readily available support to address these issues is essential (Dwivedi *et al.,* 2019). Another challenge relates to the digital literacy skills of both learners and instructors (Rasheed *et al.,* 2020a). There can be a significant variation in digital literacy levels among individuals, which can impact their ability to effectively engage with blended learning tools and platforms. Thus, providing training and support to enhance digital skills is crucial for successful implementation of blended learning initiatives.

In addition to that, blended learning brings forth pedagogical challenges that educators need to navigate. One key challenge is instructional design (Ashraf *et al.,* 2021). Designing blended learning courses requires careful consideration of how to integrate online and face-to-face components to create a cohesive learning experience (Rasheed *et al.,* 2020b). Striking the right balance between these components is essential to ensure effective learning outcomes. Additionally, aligning learning outcomes with the blended learning format poses a challenge (Maleesut *et al.,* 2019; Rasheed *et al.,* 2020a). It is important to ensure that the objectives of the course are aligned with the online and offline activities, and that there is a seamless transition between these modalities. Furthermore, sustaining learner engagement and motivation can be challenging in a blended learning environment (Dwivedi *et al.,* 2019; Rasheed *et al.,* 2020b). Students may face difficulties in maintaining their focus and accountability in both online and offline settings (Castro, 2019). Overcoming these challenges requires innovative instructional strategies and supportive learning environments.

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More still, blended learning introduces unique social and interaction challenges that educators must address. One important aspect is fostering social presence and community building in online spaces (Ghazal *et al.,* 2018). Students need to feel connected and engaged with their peers and instructors, despite the physical distance. Overcoming potential feelings of isolation and disconnectedness is crucial for creating a supportive learning community (Serrano *et al.,* 2019). Collaboration and communication also present challenges in blended learning. Facilitating effective collaboration among learners, particularly in group work scenarios, can be complex (Dwivedi *et al.,* 2019). Additionally, establishing meaningful interaction between instructors and students in both online and offline settings is essential. Providing personalized feedback and support can be more challenging in a blended learning environment, but it is vital for promoting student success and engagement (Ghazal *et al.,* 2018).

Furthermore, blended learning poses challenges related to assessment and evaluation practices. Designing appropriate assessments that align with the blended learning format is a key challenge for educators (Castro, 2019). Assessments need to effectively measure the learning outcomes while considering the unique features of both online and offline activities (Dayagbil *et al.,* 2021). Furthermore, ensuring the authenticity and integrity of assessments in online environments is crucial. Preventing academic dishonesty and maintaining assessment reliability requires the implementation of robust strategies and technologies (Gamage *et al.,* 2020). Educators must address these challenges to ensure that assessments accurately reflect students' knowledge and skills in blended learning settings.

And finally, the successful implementation of blended learning relies on adequate institutional support and resources. Establishing supportive policies and guidelines for blended learning is essential for creating a conducive environment (Ghazal *et al.,* 2018; Namyssova *et al.,* 2019). Policies should address issues such as student access to technology, intellectual property rights, and data privacy. Additionally, allocating sufficient resources for infrastructure development and maintenance is crucial (Namyssova *et al.,* 2019).

Educational institutions need to invest in technology infrastructure, software, and learning management systems to support blended learning initiatives effectively (Rasheed *et al.,* 2020a;

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Serrano *et al.,* 2019). Faculty development and training are also essential components. Providing professional development opportunities that equip instructors with the necessary pedagogical and technological skills to effectively deliver blended learning is crucial (Anthony *et al.,* 2022; Namyssova *et al.,* 2019; Rasheed *et al.,* 2020b). Lastly, comprehensive student support services should be in place to assist learners in navigating blended learning environments and to provide resources for their academic success and well-being.

Possible solutions to the challenges in Blended Learning

Blended learning presents several technological challenges that need to be addressed to ensure its successful implementation. Improving infrastructure and connectivity is crucial, as it enables students to access online resources and participate in virtual interactions seamlessly (Anthony *et al.,* 2022; Ashraf *et al.,* 2021). Institutions should invest in enhancing internet connectivity and providing devices to students who lack access (Castro, 2019; Namyssova *et al.,* 2019). Additionally, establishing dedicated technical support teams can assist students and instructors in troubleshooting technical issues promptly (Ghazal *et al.,* 2018). This support can be complemented by offering online resources and tutorials to empower learners to resolve minor technical problems independently. Moreover, integrating digital literacy training into the curriculum can enhance students' and instructors' skills in effectively using technology for learning (Dwivedi *et al.,* 2019; Namyssova *et al.,* 2019). Offering workshops, online modules, or certification programs can help improve digital literacy levels, ensuring that all participants are equipped to navigate the technological aspects of blended learning (Ghazal *et al.,* 2018; Maleesut *et al.,* 2019; Namyssova *et al.,* 2019).

More still, the effective design and implementation of blended learning courses require addressing pedagogical challenges. Instructional design support plays a critical role in assisting faculty members in developing engaging and effective course materials (Ashraf *et al.,* 2021; Castro, 2019). Institutions can offer instructional design support services to ensure that instructors have the necessary expertise to design and structure blended learning courses (Ashraf *et al.,* 2021; Namyssova *et al.,* 2019). Collaborative platforms or communities of practice can facilitate the sharing of best practices among instructors, fostering a culture of continuous improvement (Ashraf *et al.,* 2021; Castro, 2019; Namyssova *et al.,* 2019). Clear

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alignment between learning outcomes, online activities, and face-to-face interactions is essential. Providing explicit instructions, rubrics, and examples can help students understand how different components contribute to achieving the learning goals (Ghazal *et al.,* 2018; Namyssova *et al.,* 2019). Furthermore, incorporating interactive and engaging learning activities, such as discussions, case studies, simulations, and multimedia resources, can enhance learner engagement and motivation in both online and offline settings, promoting meaningful learning experiences (Anthony *et al.,* 2022; Serrano *et al.,* 2019).

Furthermore, creating a supportive and interactive learning environment is a key challenge in blended learning. Online community building is crucial to foster social presence and create a sense of community among learners (Ashraf *et al.,* 2021). Implementing online platforms, discussion forums, and social networking tools can facilitate communication and collaboration, enabling students to connect with their peers and engage in meaningful discussions (Anthony *et al.,* 2022; Rasheed *et al.,* 2020b). Establishing instructor presence is vital to provide guidance and support. Facilitating regular communication channels, such as videoconferencing and virtual office hours, enables instructors to establish a strong rapport with students and address their questions and concerns (Anthony *et al.,* 2022; Dwivedi *et al.,* 2019). Peer interaction and collaboration are also essential in blended learning environments. Implementing collaborative tools, group projects, and peer review activities promotes social interaction and knowledge sharing, fostering a sense of community and active learning (Dwivedi *et al.,* 2019; Namyssova *et al.,* 2019).

Research has indicated that, blended learning poses unique challenges related to assessment and evaluation. Employing diverse assessment methods is crucial to ensure the validity and reliability of the evaluation process (Ashraf *et al.,* 2021; Castro, 2019). This includes utilizing online quizzes, written assignments, presentations, and group projects that align with the blended learning format and effectively measure student learning outcomes. To maintain assessment integrity, academic integrity measures should be in place (Keržič *et al.,* 2019). Implementing plagiarism detection software, randomized questions, and online proctoring tools helps ensure the authenticity of student work and discourages academic dishonesty (Castro, 2019; Rasheed *et al.,* 2020b). Providing timely and constructive feedback on

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assessments is essential to support student learning and improvement. Encouraging students to reflect on their learning experiences and engage in self-assessment enhances their understanding of their progress, promoting metacognitive skills and facilitating continuous improvement (Engelmann *et al.*, 2021; Keržič *et al.*, 2019).

Finally, Institutional support and resource allocation are critical factors for the successful implementation of blended learning. Establishing clear policies and guidelines related to blended learning, student technology access, intellectual property rights, data privacy, and accessibility provides a framework for effective implementation (Castro, 2019; Namyssova *et al.*, 2019). Allocating sufficient financial resources to support infrastructure development, technology upgrades, and faculty training is essential (Ashraf *et al.*, 2021). This ensures that institutions have the necessary resources to provide a robust blended learning environment. Offering comprehensive faculty development programs that focus on pedagogical approaches, technology integration, and assessment strategies specific to blended learning equips instructors with the skills and knowledge required for effective teaching in this format (Castro, 2019). Additionally, providing comprehensive student support services, such as online tutoring, academic advising, counseling, and technical assistance, helps students navigate the blended learning environment and enhances their overall learning experience, promoting their success and well-being (Anthony *et al.*, 2022; Castro, 2019; Kabarungi *et al.*, 2023).

CONCLUSION

Blended learning, a pedagogical approach that combines face-to-face instruction with online learning, offers a multitude of advantages that contribute to an enriched and dynamic learning experience (Anthony *et al.*, 2022). One notable advantage is the provision of flexibility and personalization for learners, affording them the opportunity to access educational content and engage in learning activities at their own pace and convenience (Ashraf *et al.*, 2021; Keržič *et al.*, 2019). This adaptability enables learners to take ownership of their learning journey, tailoring it to their unique needs and preferences. Moreover, blended learning fosters active engagement and interaction among learners through the utilization of various online platforms and tools (Ashraf *et al.*, 2021; Castro, 2019). By actively participating in discussions,

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collaborating on projects, and receiving timely feedback, learners are able to deepen their understanding and retention of knowledge (Anthony *et al.*, 2022; Keržič *et al.*, 2019).
Furthermore, blended learning effectively overcomes geographical barriers, expanding accessibility and reach (Namyssova *et al.*, 2019). Learners hailing from diverse locations can access educational resources and actively participate in online discussions, transcending the limitations imposed by traditional physical boundaries (Castro, 2019; Maleesut *et al.*, 2019). This inclusive approach acknowledges and accommodates different learning styles and needs, thereby supporting a diverse range of learners. Additionally, the customization of learning paths is a significant advantage of blended learning, empowering learners to follow personalized paths that align with their specific abilities and interests (Rasheed *et al.*, 2020b).

Blended learning also serves as a catalyst for collaboration and social learning, facilitating peer-to-peer interaction and knowledge sharing (Kabarungi *et al.*, 2023). Online platforms and collaborative projects provide learners with opportunities to engage with their peers, share insights, and collectively construct knowledge (Ashraf *et al.*, 2021). Such a collaborative approach fosters the development of essential communication and teamwork skills, which are highly valued in today's interconnected world.

Moreover, technology assumes a pivotal role in blended learning by offering an array of benefits that enhance the learning experience. The integration of interactive multimedia resources, such as videos, simulations, and virtual experiments, augments learner engagement and comprehension (Anthony *et al.*, 2022; Castro, 2019). Additionally, the utilization of learning analytics provides educators with valuable insights into learners' progress and performance, enabling them to tailor instruction to individual needs and optimize the learning process (Ghazal *et al.*, 2018; Gqokonqana *et al.*, 2022).

In terms of cost-effectiveness and resource optimization, blended learning demonstrates significant advantages (Castro, 2019; Namyssova *et al.*, 2019). By reducing the dependence on extensive physical infrastructure and mitigating travel expenses, blended learning alleviates the financial burden on both educational institutions and learners(Anthony *et al.*, 2022). The efficient utilization of classroom space and resources ensures optimal allocation, maximizing

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the benefits derived from available resources (Ashraf *et al.*, 2021). Furthermore, the adoption of open educational resources diminishes the reliance on costly textbooks, thus promoting equitable access to high-quality education.

However, it is imperative to acknowledge the challenges that accompany blended learning. These challenges encompass technological limitations, pedagogical considerations, social and interaction difficulties, assessment and evaluation complexities, and the requisite institutional support and resources (Ashraf *et al.*, 2021; Castro, 2019; Keržič *et al.*, 2019). By implementing well-considered solutions to address these challenges, educational institutions can effectively harness the advantages of blended learning and create immersive and engaging learning environments that foster optimal student outcomes (Anthony *et al.*, 2022; Namyssova *et al.*, 2019; Rasheed *et al.*, 2020b).

RECOMMENDATION AND FUTURE WORK

There are certain limits to this review, but they present opportunity for additional research. First, despite a comprehensive search, it is possible that some essential information was ignored owing to a lack of specified keyword strings. Using suitable synonym keywords to build search strings is an important aspect of the search process. Secondly, this research is confined to only two categories of documents: journal articles written in English and conference papers written in English. As a consequence, some articles may have been omitted. The key recommendations based on the findings and discussions are as follows; since technological limitations, pedagogical considerations, institutional support and resources are the most challenges faced by blended learning, this research therefore recommends that before adoption of blended learning, the blended learning framework must be put in place to address all the mentioned challenges above. The future work should focus on a wide search beyond journal and conference papers and be open to other languages since blended learning is diversely adopted worldwide.

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